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ABSTRACT

This report presents a model combining the emerging technologies of hypertext and expert systems. Hypertext is relatively unexplored but promises an innovative approach to information retrieval. In contrast, expert systems have been used experimentally in many different application areas ranging from medical diagnosis to oil exploration. The information sources used in this model are limited to databases of images (object surrogates and maps), object descriptions, document surrogates (abstracts, references, excerpts), genealogical trees, and time lines of historical events. In addition to hypertext the model uses an expert system shell to generate new information from data entered at a terminal or imported from a database. Sample uses of the prototype based on the model are studied to determine the range of activities that can be performed. Apple's HyperCard and Cognition Technology's MacSMARTS are used with a knowledge base created by the author limited to Arab numismatics. Numismatists work with coins and coin surrogates. These objects contain information that is significant in isolation but is even more important when aggregated. Further, a wealth of information related to each coin ranging from historical references to analyses by art historians needs to be linked to the specific objects. The prototype developed from the model is used to show how hypertext facilitated the resolution of some specific information needs. (16 references) (Author)

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The User Interface: A Hypertext Model Linking Art Objects and Related Information

Judi Moline

This chapter presents a model combining the emerging technologies of hypertext and expert systems. Hypertext is relatively unexplored but promises an innovative approach to information retrieval. In contrast, expert systems have been used experimentally in many different application areas ranging from medical diagnosis to oil exploration. The information sources used in this model are limited to databases of images (object surrogates and maps), object descriptions, document surrogates (abstracts, references, excerpts), genealogical trees, and time lines of historical events. In addition to hypertext, the model uses an expert system shell to generate new information from data entered at a terminal or imported from a database. Sample uses of the prototype based on the model are studied to determine the range of activities that can be performed.

Apple's HyperCard and Cognition Technology's MacSMARTS are used with a knowledge base created by the author limited to Arab numismatics. Numismatists work with coins and coin surrogates. These objects contain information that is significant in isolation but that is even more important when aggregated. Further, a wealth of information related to each coin ranging from historical references to analyses by art historians needs to be linked to the specific objects. The prototype developed from the model is used to show how hypertext facilitated the resolution of some specific information needs.

INTRODUCTION

The hypertext model presented in this chapter was created to provide an environment in which the linking of art objects and related information could be explored.[1] In order to develop such an environment, a user community was identified and its needs were determined.

Recent research in information studies stresses the importance of considering the users' needs when designing information systems. Robert S. Taylor contends:

"The major, perhaps only, reason for the existence of an information system is to store and to provide information and knowledge in usable chunks to those who presently or in the future will live and work in certain environments, and who, as a result, have or will have certain problems which information may help in clarifying or even in solving" (Taylor, 1986, 24). Although information needs can be extremely personal, certain groups of individuals doing similar work or having similar training tend to need similar information systems. Thus, having an intimate knowledge of a particular user community facilitates the development of information resources for that particular group of information users.

The information system developed in this study is primarily for numismatists (coin collectors, dealers, and scholars). However, numismatic research contributes to a wide range of fields. Archaeology and ethnology, as well as historical studies in art, economics, linguistics, politics, and sociology, profit from numismatic documentation. As an information resource, numismatic literature and collections are widely distributed, difficult to access, and hard to integrate. Therefore, the development of this integrated, computerized information system designed for numismatists could serve a wider community.

Besides facilitating access of numismatic and related materials, the study of this particular user community has provided greater understanding of their needs. In working with traditional resources, each researcher juggles the information materials in an individual way. It is possible that by identifying the needs of this group, alternative ways of dealing with the resources might become apparent when using the new techniques. Further, it is expected that this model will provide input for similar studies.

NUMISMATISTS AND THEIR INFORMATION NEEDS

Collectors, dealers, and scholars often have large files itemizing their collections. Some of the files are records of coins held by the collector while others are records of coins pertinent to a particular research topic. In either case, the indexer sets up a cataloging system and creates the entries, which contain fields of information, usually in a prescribed order. Further, the vocabulary is often limited to a predetermined set of words. Thus, consistency in format or vocabulary is achieved only by rigid adherence to a scheme designed in advance of record entry. To date, uniformity and standardization among collections have not been a major concern.

In order to compile their coin catalogs, numismatists consult a variety of information sources. First of all, there is usually a standard reference for the particular type of coin against which coins are compared. This reference provides a number for each coin face. The reference for the obverse or front of the coin is not necessarily the same as for the reverse. The standard reference might be the catalog of a comprehensive collection or it might be a compilation of many collections with reference numbers unique to the publication. In addition to the standard reference, other coin catalogs are also necessary. The researcher dealing

with unique or rare specimens wants to have as much information as possible about all of the extant coins of the type under study.

By matching details of the coins, a coin can be identified. Identification usually includes an identification number, physical information (the metal, weight, diameter, and die axis), descriptive information (images and inscriptions), historical reference information (dynasty, date, ruler, region, and mint), references (publication[s] including similar coin[s]), and information on where and when the coin was obtained. Further, depending upon the reason for the catalog, it may contain the cost of the item and its current value.[2]

Not all of this information is contained on the faces of the coin. Other resources are needed to relate named individuals to their period in history, to locate mints, to discuss minting customs and economic policy of the period, and to identify similar or identical objects.

Numismatists are using computers to help them with their research. Inventories are currently maintained on computers for museum as well as private collections. Further, a review of numismatic literature since the early 1980s points to increased interest in the use of computers. Twenty-two articles were found, and the topics include statistical methodology, classification, die link analysis and chronology, taxonomy, database, distribution, and estimating coinage and number of dies (*American Numismatic Society*, nos. 111–20).

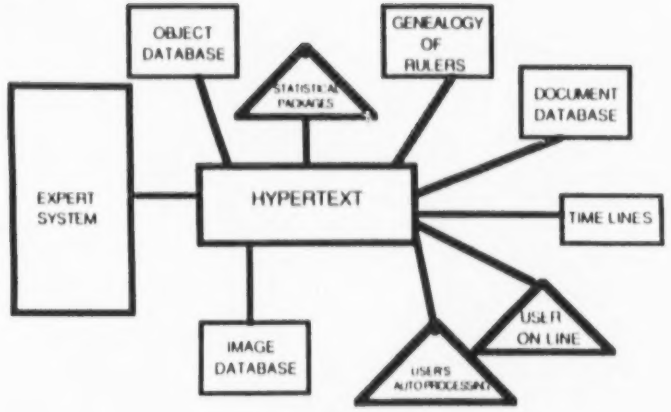
THE MODEL

The model (figure 10.1) shows a variety of resources and tools surrounding hypertext. Hypertext serves to link the tools and resources. For example, the user can proceed from a record in one database directly to a record in another database. These records may be text, graphics, or both. The diagram takes into consideration the types of resources that might be needed by the users. The resources include a variety of databases. These databases replace the books or card files that a researcher would normally consult, for example, images, documents, and inventory. In addition to information resources, tools that would facilitate the researcher's work are included in the model (e.g., statistics, expert system).

The Collection Used in the Prototype of the Model

The collection of the British Museum (Walker, 1956, 5, 12–14, 32, 236–39) is used as the reference set for this model. It totals 28 coins, with 1 coin showing an emperor standing, 9 coins showing an emperor and his son standing, 2 coins showing a caliph standing, and 16 coins of the postreform type. The author has references for a total of 118 coins (1 of the emperor standing, 39 of the emperor and son, 7 of the caliph, and 71 postreform). The additional 90 coins were used as needed to simulate user input. All of these coins include the name of the mint

Figure 10.1
The Model



Note: Items in triangles have not yet been implemented

because, to date, that is the only determining factor for a coin to have been minted in Baalbek.[3]

The objects used in this study are limited to Arab coins minted in Baalbek. Coins were minted at Baalbek under Byzantine rule, although there were no operational mints there at the time of its occupation by the Arabs. However, under the Arabs the minting of copper coins was reinstated. The copper coins that were minted there are similar in style and content to those of the neighboring cities.

The Tools Provided in the Prototype of the Model

Hypertext. Hypertext is ill-defined but includes the idea of nonlinear retrieval. When people read a journal article, they proceed in a linear fashion going from page one to page *n*. In contrast, when consulting a reference work, the user proceeds in a nonlinear manner. Topics are pursued as needed in a logical manner for that particular session, but that order may appear random at a later time. This latter method of nonlinear searching might be considered a basic model for hypertext. An initial interest or need for information results in accessing a particular database or information resource. Ideas, concepts, particular words, or illustrations spark interest in related ideas, and each user follows a particular interest or need. The materials with links built in allowing the user to jump from what appears to be one page to another, or one document to another, are referred to collectively as hypertext.

There are several hypertext software packages on the market.[4] What they all

have in common is this facility of allowing the users to follow alternative paths through the contents of a database or databases. Some of the hypertext products provide complete functionality.[5] These products often have a prescribed default screen design, which allows input of material, particularly of text, without the user having to be concerned with layout design. They also usually have links that are associated with a particular word, phrase, or graphic. Other products facilitate the development of hypertext. These products do not provide a default layout but rather provide the tools that allow the creation of hypertext. HyperCard is of the latter type. In HyperCard the databases are called *stacks* and the primary type of link is called a *button*. Each record is called a *card*. Since HyperCard is an Apple product for the Macintosh, it uses the customary Apple menu interface. Clicking on a button results in an action, as does pulling down and pausing on an item in the menu bar. What is linked is dependent upon the individual or group setting up the particular implementation of hypertext.

Stacks are readily available as well as easily made. As stacks are developed, the author includes links that are appropriate to meet the objectives of the current work. Since links may be added at any time, the user could link stacks of diverse origin to make the information available in a way that is personally and immediately useful.

The model presented in this paper contains databases of text, graphics, and graphics integrated with text. The databases include records containing catalog entries (figure 10.2), genealogy (figure 10.3), maps (figure 10.4), passages from reference works concerning Baalbek (figure 10.5), minting as well as passages dealing with the analysis of Arab coins of the period under consideration (figure 10.6). Further, both scanned images (figure 10.2) and line drawings (figures 10.3 and 10.4) are included.

Expert Systems. Although not new, artificial intelligence, especially in the form of expert systems, is one of the newer tools to be provided for the researcher.[6] In its simplest form, an expert system has three components: a knowledge base, an inference engine, and a user interface. An expert system shell provides the inference engine and an interface to facilitate the construction of the knowledge base (Shafer, 1988, 132). The knowledge base depends on structured rules, called production rules, that may be written and entered as rules by the expert and/or may be generated by the software from a series of examples that are entered for this purpose or that are present in a database. The following are sample expert system rules:

Note: Early Umayyad Coin Types

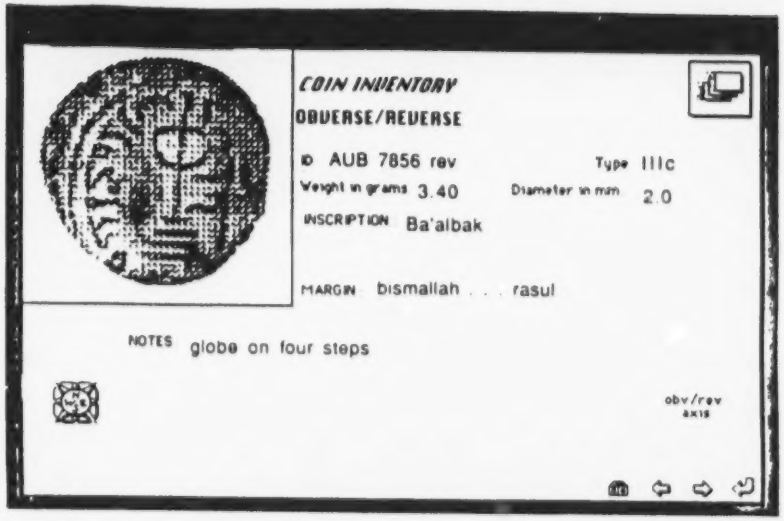
Rule: 0

IF: coin obverse has emperor standing

AND: coin reverse has a large capital letter *M* in the field

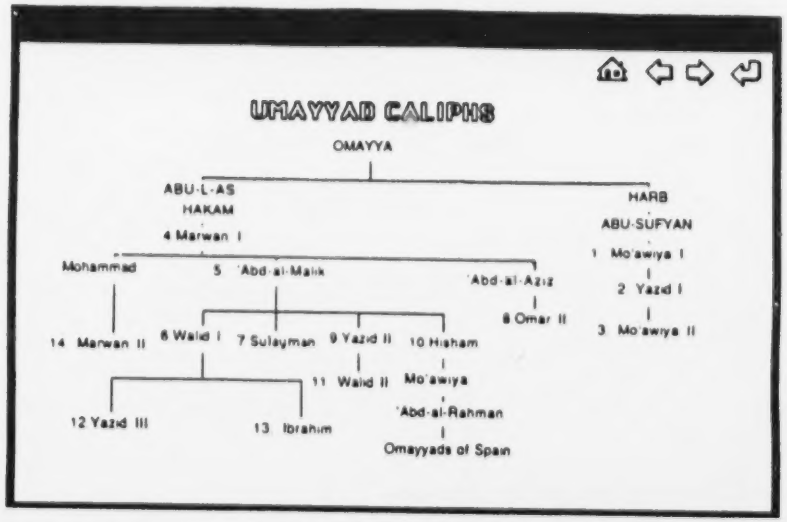
AND: reverse has Greek letters on each side of the *M* in vertical rows

Figure 10.2
Object Database, Sample Card



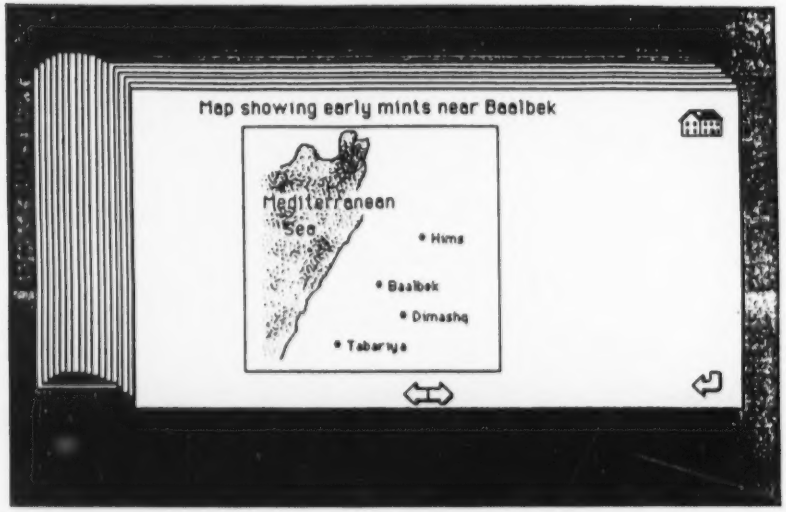
Source: Various HyperCard graphics and icons ©Apple Computer, Inc. Used with permission.

Figure 10.3
Genealogy of Rulers, Sample Card



Source: Various HyperCard graphics and icons ©Apple Computer, Inc. Used with permission.

Figure 10.4
Image Database, Sample Card



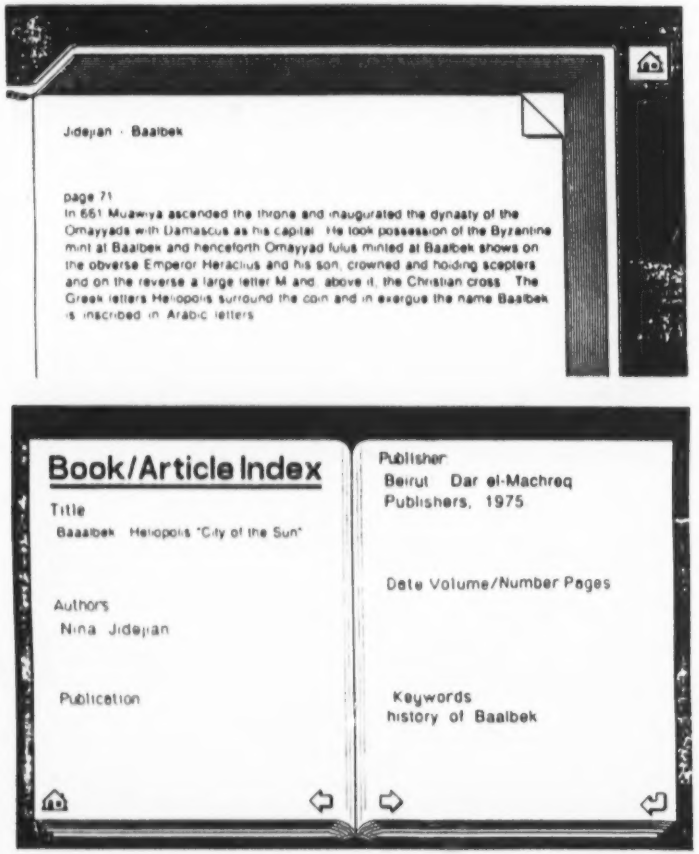
Source: Various HyperCard graphics and icons ©Apple Computer, Inc. Used with permission.

AND: reverse has Arabic inscription below the *M*
THEN: coin might be an early Umayyad fulus of Type IIb

Rule: 1
Show: COIN IIb
IF: coin might be an early Umayyad fulus of Type IIb
AND: coin diameter is approximately 2.16 mm
AND: coin weight is approximately 7.59 grams
AND: obverse has Greek inscription running downwards in right field
AND: vertical rows on reverse are POLE PLIO
AND: Arabic inscription below the *M* is Ba'labakk
CONCLUSION: coin was minted in Baalbek just before A.D. 692

Rule: 2
IF: coin obverse has two standing figures appearing to be Greek
ANDNOT: obverse has inscription
AND: coin reverse has a large capital letter *M* in the field
AND: reverse has Greek letters on each side of the *M* in vertical rows
AND: reverse has Arabic inscription below the *M*
THEN: coin might be an early Umayyad fulus of Type IIc

Figure 10.5
Document Database, History of Baalbek


Jidejian - Baalbek
page 71
In 661 Muawiya ascended the throne and inaugurated the dynasty of the Omayyads with Damascus as his capital. He took possession of the Byzantine mint at Baalbek and henceforth Omayyad fulus minted at Baalbek shows on the obverse Emperor Heraclius and his son, crowned and holding scepters and on the reverse a large letter M and, above it, the Christian cross. The Greek letters Heliopolis surround the coin and in exergue the name Baalbek is inscribed in Arabic letters
Book/Article Index
Title
Baaalbek Heliopolis "City of the Sun"
Authors
Nina Jidejian
Publication
Publisher
Beirut Dar el-Machreq Publishers, 1975
Date Volume/Number Pages
Keywords
history of Baalbek

Source: Various HyperCard graphics and icons ©Apple Computer, Inc. Used with permission.

Rule: 3
IF: coin might be an early Umayyad fulus of Type IIc
SHOW: coin IIc
AND: Greek letters on reverse are (HE)LIO POLE
AND: Arabic inscription is Ba'labakk
CONCLUSION: Coin was minted in Baalbek about A.D. 692

Rule: 4
IF: coin obverse has bust of Greek emperor

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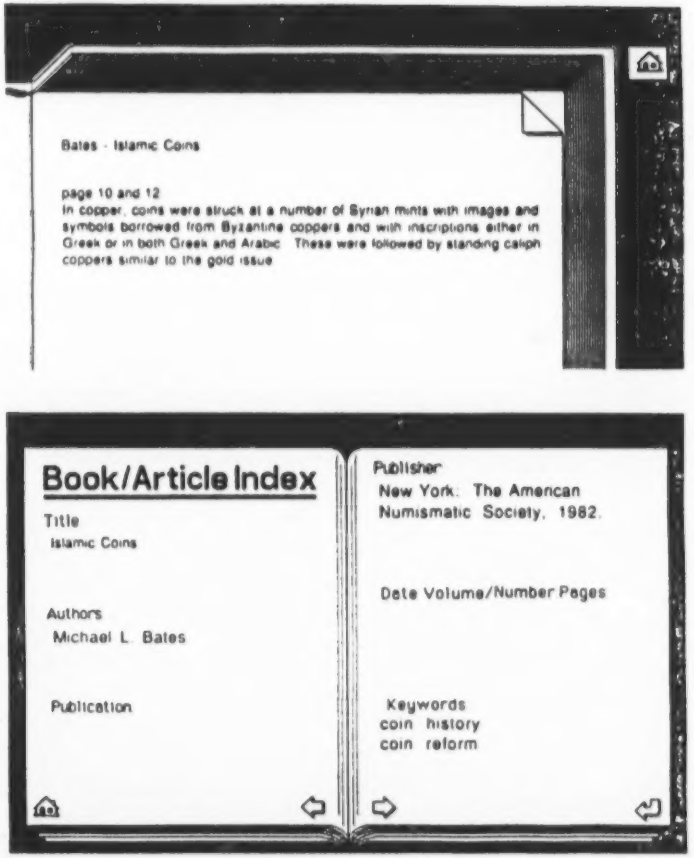
Figure 10.6
Document Database, Minting of Coins


Bates - Islamic Coins
page 10 and 12
In copper, coins were struck at a number of Syrian mints with images and symbols borrowed from Byzantine coppers and with inscriptions either in Greek or in both Greek and Arabic. These were followed by standing caliph coppers similar to the gold issue
Book/Article Index
Title
Islamic Coins
Authors
Michael L. Bates
Publication
Publisher
New York: The American Numismatic Society, 1982.
Date Volume/Number Pages
Keywords
coin history
coin reform

Source: Various HyperCard graphics and icons ©Apple Computer, Inc. Used with permission.

AND: obverse has Arabic letters on right side
AND: coin reverse has a large small letter *m* in the center
AND: reverse has Greek letters vertically placed on each side of *m*
AND: reverse has Arabic inscription below the *m*
THEN: coin might be an early Umayyad fulus of the Type IIe

Rule: 5
IF: coin might be an early Umayyad fulus of the Type IIe
AND: coin weight is approximately between 2 and 5 grams
AND: coin diameter is approximately between 1.5 and 2.5 mm
AND: obverse has Arabic inscription running down right side, b'Homs
AND: Greek letters on reverse are EMI CHC
AND: Arabic inscription on reverse below the line is tiyyib
CONCLUSION: coin was minted in Homs/Emesa about A.D. 692

Rule: 6
IF: coin obverse has an image of the caliph
AND: coin has Arabic inscription on both obverse and reverse
AND: coin has a cross on steps or a large letter *M* on reverse
AND: coin weighs approximately between 3.4 and 4.8 grams
AND: coin diameter is approximately between 19 and 21 mm
THEN: coin might be an early Umayyad fulus of the Type IIIc

Rule: 7
IF: coin might be of the Arab Type of early Umayyad coins
AND: coin obverse has caliph standing
AND: coin reverse has globe on steps
AND: reverse on right side of globe standard has mint, Ba'labakk
AND: obverse has marginal inscription
AND: obverse marginal inscription might begin with Bismallah
AND: reverse marginal legend begins, Bismallah
AND: reverse marginal legend contains, la ilah illa Allah wahadah
AND: reverse marginal legend ends with Muhammad
CONCLUSION: coin was minted in Baalbek between A.D. 694–696

When integrated into a hypertext system, the advice given to the user by the "expert" allows the generalist to benefit from the knowledge and experience of the real expert.

Generation of User Stacks and Reports

The user of the prototype system may decide to develop personalized stacks. These may consist of copies of any of the cards in the prototype or items added by the user. Allowing the user to manipulate the source materials and link them makes this resource appealing to many. If care is taken, the original stacks will remain as they were created so that the user can "seek, copy, and link" at will without spoiling the integrity of the materials for future users. Further, most of the products provide a print capability that allows particular cards to be printed as they appear on the screen or as part of a report.

In addition to the tools previously mentioned, a note-taking facility has been included in the prototype of the model. The button labeled *notes* takes the user to a file in which notes can be written for later access. When the user quits the word processor, the system returns to the screen at which the request for the word processor was made. Further, links to structured databases may be added.

Integration of an Expert System into Hypertext

It is possible to launch a knowledge base from some hypertext systems. For example, in HyperCard the button controlling the action is simply scripted to open a specific file or document with a particular application. When the user quits the knowledge base, the system returns to the same card that was being viewed when the interruption occurred. This is possible because the position in the file at the time of the interruption is noted. It is also possible to return the user to a place directly related to the result of the interaction with the knowledge base.

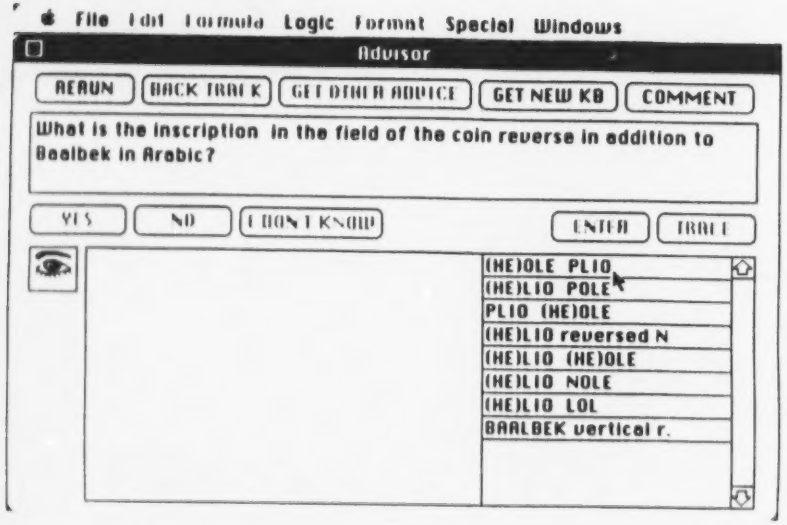
As an illustration of this, the following sample search is included. The user might have a coin to identify. The first step would be to flip through the stack of images to find the image most like the coin. The user would then select "Advice" on the screen and would be linked with the knowledge base that deals with similar coin faces. A series of questions would be asked (figures 10.7 and 10.8) by the "expert" to ascertain which of the coin records contained in the coin inventory would be most like the coin being described.

If the expert system is able to determine that the coin is like one in the coin inventory, the user would be advised that the coin is similar to British Museum coin *X* and would be advised to compare the coin detail by detail with the description contained on the inventory card for that coin. On the other hand, if the expert system is unable to reach a satisfactory conclusion, the user would be returned to the image stack for further matching.

Design of the Data in the Prototype of the Model

The data in the prototype of the model is limited to that which is directly related to the reference set of coins, those of the British Museum. The following

Figure 10.7
Expert System, Sample Question



Source: Cognition Technology

stacks or databases are included: table of contents, images, objects (inventory), genealogy, time line, documents (coin history and reforms, Baalbek history, and related use of computer in numismatics), maps, glossary, and Arabic-to-English term list. Various screen backgrounds are used to relate specific types of information with particular formats. However, the interface is consistent with regard to the "buttons" that are uniform in placement among the stacks, although not every button appears on each card. The visible buttons are uniform in type and placement among the stacks. However, not every button appears on each card.

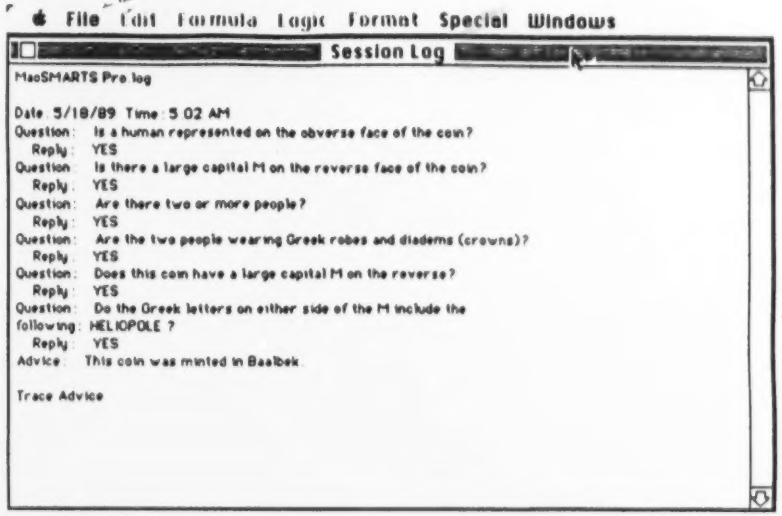
Links in the data model. There are links in the prototype that connect the expert system and the related knowledge bases to the image stack, as well as the object stack. Further, the other stacks are all interlinked (figure 10.9). In addition, the word processor is accessible from each card in each stack for note taking or copying the contents of the card.

Status of implementation of the model. The amount of data contained in the prototype at this moment is limited. However, all aspects of the model presented as operational have been implemented.

DISCUSSION AND LIMITATIONS

The model facilitates the categorization of Arab coins. It is certainly easier to interact with the computer than it is to sort through catalogs trying to match

Figure 10.8
Expert System, Sample Log


File Edit Formula Logic Format Special Windows
Session Log
MacSMARTS Pro log
Date: 5/18/89 Time: 5:02 AM
Question: Is a human represented on the obverse face of the coin?
Reply: YES
Question: Is there a large capital M on the reverse face of the coin?
Reply: YES
Question: Are there two or more people?
Reply: YES
Question: Are the two people wearing Greek robes and diadems (crowns)?
Reply: YES
Question: Does this coin have a large capital M on the reverse?
Reply: YES
Question: Do the Greek letters on either side of the M include the following: HELIOPOLE ?
Reply: YES
Advice: This coin was minted in Baalbek
Trace Advice

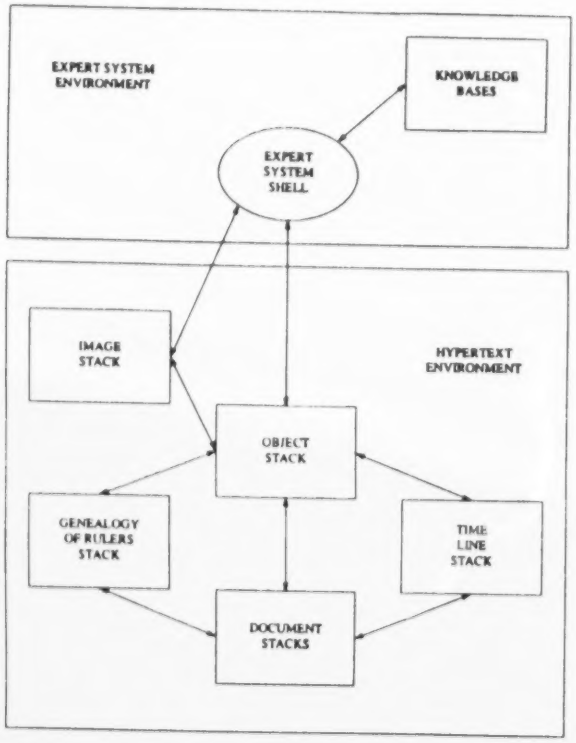
Source: Cognition Technology

images or descriptions. The expert system environment of the prototype emulates working with an expert to identify a coin. An alternative to this, the hypertext environment, is also available. Hypertext allows "browsing" so that, for example, a user could identify a coin type and then browse the stack to look at other coins of the type. However, to be useful to the general collector of coins, there must be rules to cover a wider range of coins.

As regards the hypertext application, the linking of diverse materials is very effective. However, once the "stacks" become extensive, finding material that has not been properly linked is not easy. The importance of anticipating the uses is crucial. However, databases can be linked into the model and their search capabilities used.

Even better than linking a database search capability would be the development of an automatic linking capability. This would require an automatic indexing system. Another desired capability, which is not yet part of the implemented model, is the means for including statistical formulas. For example, the numismatist might be interested in discriminate analysis, probability, or covariance between coin production and remaining coins. If calculations and running totals could be kept on "marked" items as a separate file, aggregating information and doing cluster analysis to determine similarity of the items in a set would be facilitated.

Figure 10.9
Links Among Stacks and with the Expert System



CONCLUSIONS

Hypertext provides a friendly user interface that facilitates access of material and information-processing resources that have been carefully structured and linked. The material may be included in a variety of types of databases and document or graphics files. Further, diverse applications might be available to the basic hypertext interface.

The needs of numismatists as information users may be facilitated by the use of computers and specifically hypertext and expert systems. However, the present study is on a small scale. More work is necessary to determine if the model could be scaled up and the scope of the materials could be increased to include all Arab coins or all ancient coins. Further, the issues of information retrieval and pre- versus postcoordinated links need to be analyzed based on case studies documenting uses of the prototype.

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NOTES

1. The need for linking the objects and information is not discussed here. The Fall 1988 issue of *Library Trends* (Stam and Giral, 1988, 117–264) provides discussion of many of the issues.

2. To illustrate how extensive the fields for each coin entry might be, the following list is that contained in the *Islamic Manual* used by the American Numismatic Society (New York City) in 1983: analysis of coin's metal content, artist, die axis, first common era date, second common era date, color, counterstamp, department, decoration name, denomination, decoration guide, disposition (from ANS collection), date of object, dynasty or issuing government, edge marking, era by which coin is dated, estimated value, previous owner(s), where and when exhibited, date of valuation, place where found or acquired, other information, issuer, location (if abnormal), standard abbreviation of mint, maker, manufacture, material, dimension(s), mint where issued, object identification number, negative or slide number, obverse inscription, obverse type or image, person named on object, province (locality where issued), publication of *this* object, catalog reference, general area where issued, reverse inscription, reverse type or image, classification by subject, shape, classification by institution, series number, value of object, classification by person, classification by place, symbol, type (kind of object), undertype, and weight.

3. Baalbek is located in the Biqaa Valley of Lebanon. Since early times Baalbek was an important crossroads because it is on a major north-south corridor and near a mountain pass giving access to the city of Damascus. It was a major outpost of the Roman Empire and continued to be an important city with the Arab expansion by the Umayyads around A.D. 650.

4. "Hyper Activity" (*Byte*, 1988, 268) lists the following commercial hypertext products: Business File Vision (Marvelin Corp.), Document Examiner (Symbolics, Inc.), Graphic KRS/Text KRS/Hyper KRS (Knowledgeset Corp.), Guide (Owl International, Inc.), HyperCard (Apple Computer, Inc.), KMS (Scribe Systems, Inc.), Knowledge Pro (Knowledge Garden, Inc.), MacSMARTS (Cognition Technology Corp.), and Marcon (AIRS).

5. Certain commercial products are identified in this paper in order to specify adequately the procedures being described. In no case does such identification imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the material identified is necessarily the best for the purpose.

6. Dan Shafer's article "Getting Smart," *Macworld* (October 1988), includes some expert systems that are available for the Macintosh computer. Those listed (p. 138) are Cognate (Peridom), Intelligent Developer/IntelliCard (Hyperpress Technology Group), Instant-Expert Plus (Human Intellect Systems), MacSMARTS (Cognition Technology Corp.), and Nexpert Object (Neuron Data).

REFERENCES

American Numismatic Society. n.d. "Islamic Manual." New York: The American Numismatic Society.